CLAIMS

1. A texture information assignment method for a shape model, comprising the steps of:

describing a shape of an object of interest as a shape model by a set of a plurality of three-dimensional shape constituent elements; and

assigning texture information for said shape model to each said three-dimensional shape constituent element on the basis of a plurality of object image information captured by shooting said object of interest from different viewpoints, according to a texture information amount for said three-dimensional shape constituent element of said each object image information.

2. The texture information assignment method according to claim 1, wherein said texture information amount is represented by a matching degree between a direction of a surface normal of said each three-dimensional shape constituent element and a direction in which said each object image information is captured each for said object three-dimensional shape constituent element.

3. The texture information assignment method according to claim 1, wherein said texture information amount is represented by an area of said three-dimensional shape constituent element projected on said each object image information each for said three-dimensional shape constituent element.

4. A texture information assignment method for a shape model comprising the steps of:

describing a shape of an object of interest as a shape model by a set of a plurality of three-dimensional shape constituent elements; and

assigning texture information for said shape model to each said three-dimensional shape constituent element on the basis of a plurality of object image information captured by shooting said object of interest from

different viewpoints, according to both a texture information amount for said three-dimensional shape constituent element of said each object image information and texture continuity between said three-dimensional shape constituent elements.

5. The texture information assignment method according to claim 4, wherein said step of assigning texture information comprises the step of assigning texture information for said shape model from said object image information corresponding to each said three-dimensional shape constituent element so as to minimize an evaluation function that decreases in accordance with increase of said texture information amount and that decreases in accordance with improvement in the texture continuity between said three-dimensional shape constituent elements.

6. The texture information assignment method according to claim 5, wherein said evaluation function has said texture continuity represented as a function of difference in a shooting position and a shooting direction of respective said object image information between a three-dimensional shape constituent element of interest and a three-dimensional shape constituent element adjacent thereto.

7. The texture information assignment method according to claim 5, wherein said evaluation function has said texture continuity represented as a function that increases in accordance with increase of difference between a label number assigned to a three-dimensional shape constituent element of interest and a label number assigned to a three-dimensional shape constituent element adjacent to said three-dimensional shape constituent element of interest when said object image information is captured according to change in position and a label number corresponding to the change in position is assigned to each object image information.

8. The texture information assignment method according to claim 5, wherein said evaluation function has said texture continuity represented as

a function that increases in accordance with increase of difference between a label number assigned to a three-dimensional shape constituent element of interest and a label number assigned to a three-dimensional shape constituent element adjacent to said three-dimensional shape constituent element of interest when said object image information is captured according to regular change in position and a label number is assigned to each object image information.

9. The texture information assignment method according to claim 5, wherein said evaluation function has said texture information amount represented as a function of an area of said three-dimensional shape constituent element projected on said each object image information each for said three-dimensional shape constituent element.

10. The texture information assignment method according to claim 5, wherein said evaluation function has said texture information amount represented as a function of a matching degree between a direction of a surface normal of said each three-dimensional shape constituent element and a direction in which said each object image information is captured each for said three-dimensional shape constituent element.

11. The texture information assignment method according to claim 5, wherein said evaluation function is represented as a linear combination of a total sum for all three-dimensional shape constituent elements of the difference between a label number assigned to the i-th (i: natural number) three-dimensional shape constituent element and a label number assigned to a three-dimensional shape constituent element adjacent to said i-th three-dimensional shape constituent element, and a total sum for all three-dimensional shape constituent elements of an area of said i-th three-dimensional shape constituent element projected on said object image information corresponding to the label number assigned to said i-th three-dimensional shape constituent element.

12. A texture information assignment method for a shape model comprising the steps of:

describing a shape of an object of interest as a shape model by a set of a plurality of three-dimensional shape constituent elements;

when a plurality of object image information are captured according to change in position and a label number corresponding to change in position is assigned to said each object image information, relating correspondence between said three-dimensional shape constituent element and said label number so as to minimize an evaluation function that decreases in accordance with increase of a texture information amount for said each three-dimensional shape constituent element and that decreases in accordance with improvement in texture continuity of texture information respectively assigned to said each three-dimensional shape constituent element and a three-dimensional shape constituent element adjacent thereto; and

assigning texture information to said three-dimensional shape constituent element by carrying out a weighted mean process according to an area of said three-dimensional shape constituent element projected on said each object image information on the basis of object image information corresponding to said related label number and the object image information corresponding to a predetermined number of label numbers including said related label number.

13. A texture information assignment method for a shape model comprising the steps of:

describing a shape of an object of interest as a shape model by a set of a plurality of three-dimensional shape constituent elements;

when a plurality of object image information are captured in accordance with regular change in position and a label number is assigned to each said object image information, relating correspondence between each said three-dimensional shape constituent element and said label number so as to minimize an evaluation function that decreases in accordance with increase of a texture information amount corresponding to

said each three-dimensional shape constituent element, and that decreases in accordance with improvement in texture continuity of texture information respectively assigned to said each three-dimensional shape constituent element and a three-dimensional shape constituent element adjacent thereto; and

assigning texture information to said three-dimensional shape constituent element by carrying out a weighted mean process according to an area of said three-dimensional shape constituent element projected on said each object image information on the basis of the object image information corresponding to said related label number and the object image information corresponding to a predetermined number of label numbers including said related label number.

14. A texture information assignment method for a shape model comprising the steps of:

capturing a plurality of object image information by shooting an object of interest from different viewpoints;

describing a shape of said object of interest as a shape model by a set of a plurality of three-dimensional shape constituent elements; and

assigning, to each said three-dimensional shape constituent element, texture information obtained by carrying out a weighted mean process for a plurality of said object images information according to an area of said three-dimensional shape constituent element projected on said plurality of object image information respectively.

15. A medium storing a program for causing a computer to assign texture information to a shape model, said program comprising the steps of:

describing a shape of an object of interest as a shape model by a set of a plurality of three-dimensional shape constituent elements; and

assigning texture information for said shape model to each said three-dimensional shape constituent element on the basis of a plurality of object image information captured by shooting said object of interest from different viewpoints, according to a texture information amount for said

three-dimensional shape constituent element of said each object image information.

16. The medium storing the texture information assignment program according to claim 15, wherein said texture information amount is represented by a matching degree of a direction of a surface normal of said each three-dimensional shape constituent element and a direction in which said each object image information is captured each for said object three-dimensional shape constituent element.

17. The medium storing the texture information assignment program according to claim 15, wherein said texture information amount is represented by an area of said three-dimensional shape constituent element projected on said each object image information each for said three-dimensional shape constituent element.

18. A medium storing a program for causing a computer to assign texture information to a shape model, said program comprising the steps of:

describing a shape of an object of interest as a shape model by a set of a plurality of three-dimensional shape constituent elements; and

assigning texture information for said shape model to each said three-dimensional shape constituent element on the basis of a plurality of object image information captured by shooting said object of interest from different viewpoints, according to both a texture information amount for said three-dimensional shape constituent element of said each object image information and texture continuity between said three-dimensional shape constituent elements.

19. The medium storing the texture information assignment program according to claim 18, wherein said step of assigning texture information comprises the step of assigning texture information for said shape model from said object image information corresponding to each said three-dimensional shape constituent element so as to minimize an

evaluation function that decreases in accordance with increase of said texture information amount and that decreases in accordance with improvement in the texture continuity between said three-dimensional shape constituent elements.

20. The medium storing the texture information assignment program according to claim 19, wherein said evaluation function has said texture continuity represented as a function of difference in a shooting position and shooting direction of respective said object image information between a three-dimensional shape constituent element of interest and a three-dimensional shape constituent element adjacent thereto.

21. The medium storing the texture information assignment program according to claim 19, wherein said evaluation function has said texture continuity represented as a function that increases in accordance with increase of difference between a label number assigned to a three-dimensional shape constituent element of interest and a label number assigned to a three-dimensional shape constituent element adjacent to said three-dimensional shape constituent element of interest when said object image information is captured according to change in position and a label number corresponding to change in position is assigned to each object image information.

22. The medium storing the texture information assignment program according to claim 19, wherein said evaluation function has said texture continuity represented as a function that increases in accordance with increase in difference of a label number assigned to a three-dimensional shape constituent element of interest and a label number assigned to a three-dimensional shape constituent element adjacent to said three-dimensional shape constituent element of interest when said object image information is captured in accordance with regular change in position and a label number is assigned to each object image information.

23. The medium storing the texture information assignment program according to claim 19, wherein said evaluation function has said texture information amount represented as a function of an area of said three-dimensional shape constituent element projected on said each object image information each for said three-dimensional shape constituent element.

24. The medium storing the texture information assignment program according to claim 19, wherein said evaluation function has said texture information amount represented as a function of a matching degree between a direction of a surface normal of said each three-dimensional shape constituent element and a direction in which said each object image information is captured each for said three-dimensional shape constituent element.

25. The medium storing the texture information assignment program according to claim 19, wherein said evaluation function is represented as a linear combination of a total sum for all three-dimensional shape constituent elements of the difference between a label number assigned to the i-th (i: natural number) three-dimensional shape constituent element and a label number assigned to a three-dimensional shape constituent element adjacent to said i-th three-dimensional shape constituent element, and a total sum for all three-dimensional shape constituent elements of an area of said i-th three-dimensional shape constituent element projected on said object image information corresponding to the label number assigned to said i-th three-dimensional shape constituent element.

26. A medium storing a program for causing a computer to assign texture information to a shape model, said program comprising the steps of:

describing a shape of an object of interest as a shape model by a set of a plurality of three-dimensional shape constituent elements;

when a plurality of object image information are captured according

to change in position and a label number corresponding to change in position is assigned to said each object image information, relating correspondence between said each three-dimensional shape constituent element and said label number so as to minimize an evaluation function that decreases in accordance with increase of a texture information amount for said each three-dimensional shape constituent element and that decreases in accordance with improvement in texture continuity of texture information assigned to said each three-dimensional shape constituent element and a three-dimensional shape constituent element adjacent thereto; and

assigning texture information to said three-dimensional shape constituent element by carrying out a weighted mean process according to an area of said three-dimensional shape constituent element projected on said each object image information on the basis of object image information corresponding to said related label number and the object image information corresponding to a predetermined number of label numbers including said related label number.

27. A medium storing a program for causing a computer to assign texture information to a shape model, said program comprising the steps of:

describing a shape of an object of interest as a shape model by a set of a plurality of three-dimensional shape constituent elements;

when a plurality of object image information is captured in accordance with regular change in position and a label number is assigned to said each object image information, relating correspondence between each said three-dimensional shape constituent element and said label number so as to minimize an evaluation function that decreases in accordance with increase of a texture information amount corresponding to said each three-dimensional shape constituent element, and that decreases in accordance with improvement in texture continuity of texture information respectively assigned to said each three-dimensional three-dimensional shape constituent element and a three-dimensional shape constituent element adjacent thereto; and

assigning texture information to said three-dimensional shape constituent element by carrying out a weighted mean process according to an area of said three-dimensional shape constituent element projected on said each object image information on the basis of the object image information corresponding to said related label number and the object image information corresponding to a predetermined number of label numbers including said related label number.

28. A medium storing a program for causing a computer to assign texture information to a shape model, said program comprising the steps of:

capturing a plurality of object image information by shooting an object of interest from different viewpoints;

describing a shape of said object of interest as a shape model by a set of a plurality of three-dimensional shape constituent elements; and

assigning, to each said three-dimensional shape constituent element, texture information obtained by carrying out a weighted mean process for a plurality of said object image information according to an area of said three-dimensional shape constituent element projected on said plurality of object images information respectively.

29. A texture information assignment apparatus for a shape model comprising:

means for describing a shape of an object of interest as a shape model by a set of a plurality of three-dimensional shape constituent elements; and

means for assigning texture information for said shape model to each said three-dimensional shape constituent element on the basis of a plurality of object image information captured by shooting said object of interest from different viewpoints, according to a texture information amount for said three-dimensional shape constituent element of said each object image information.

30. The texture information assignment apparatus according to

claim 29, wherein said texture information amount is represented by a matching degree between a direction of a surface normal of said each three-dimensional shape constituent element and a direction in which said each object image information is captured each for said three-dimensional shape constituent element.

31. The texture information assignment apparatus according to claim 29, wherein said texture information amount is represented by an area of said three-dimensional shape constituent element projected on said each object image information each for said three-dimensional shape constituent element.

32. A texture information assignment apparatus for a shape model, comprising:

means for describing a shape of an object of interest as a shape model by a set of a plurality of three-dimensional shape constituent elements; and

means for assigning texture information for said shape model each for said three-dimensional shape constituent element on the basis of a plurality of object image information captured by shooting said object of image from different viewpoints, according to both a texture information amount for said three-dimensional shape constituent element of said each object image information and texture continuity between said three-dimensional shape constituent elements.

33. The texture information assignment apparatus according to claim 32, wherein said means for assigning texture information assigns texture information for said shape model from said object image information corresponding to each said three-dimensional shape constituent element so as to minimize an evaluation function that decreases in accordance with increase of said texture information amount and that decreases in accordance with improvement in the texture continuity between said three-dimensional shape constituent elements.

34. The texture information assignment apparatus according to claim 33, wherein said evaluation function has said texture continuity represented as a function of difference in a shooting position and shooting direction of respective said object image information between a three-dimensional shape constituent element of interest and a three-dimensional shape constituent element adjacent thereto.

35. The texture information assignment apparatus according to claim 33, wherein said evaluation function has said texture continuity represented as a function that increases in accordance with increase of difference between a label number assigned to a three-dimensional shape constituent element of interest and a label number assigned to a three-dimensional shape constituent element adjacent to said three-dimensional shape constituent element of interest when said object image information is captured according to change in position and a label number corresponding to the change in position is assigned to each object image information.

36. The texture information assignment apparatus according to claim 33, wherein said evaluation function has said texture continuity represented as a function that increases in accordance with increase of difference between a label number assigned to a three-dimensional shape constituent element of interest and a label number assigned to a three-dimensional shape constituent element adjacent to said three-dimensional shape constituent element of interest when said object image information is captured according to regular change in position and a label number is assigned to each object image information.

37. The texture information assignment apparatus according to claim 33, wherein said evaluation function has texture information amount represented as a function of an area of said three-dimensional shape constituent element projected on said each object image information each for said three-dimensional shape constituent element.

38. The texture information assignment apparatus according to claim 33, wherein said evaluation function has said texture information amount represented as a function of a matching degree between a direction of a surface normal of said each three-dimensional shape constituent element and a direction in which said each object image information is captured each for said three-dimensional shape constituent element.

39. The texture information assignment apparatus according to claim 33, wherein said evaluation function is represented as a linear combination of a total sum for all three-dimensional shape constituent elements of the difference between a label number assigned to the i-th (i: natural number) three-dimensional shape constituent element and a label number assigned to a three-dimensional shape constituent element adjacent to said i-th three-dimensional shape constituent element, and a total sum for all three-dimensional shape constituent elements of an area of said i-th three-dimensional shape constituent element projected on said object image information corresponding to the label number assigned to said i-th three-dimensional shape constituent element.

40. A texture information assignment apparatus for a shape model, comprising:

means for describing a shape of an object of interest as a shape model by a set of a plurality of three-dimensional shape constituent elements;

means for relating, when a plurality of object images information are captured according to change in position and a label number corresponding to change in position is assigned to said each object image information, correspondence between said three-dimensional shape constituent element and said label number so as to minimize an evaluation function that decreases in accordance with increase of a texture information amount for said each three-dimensional shape constituent element and that decreases in accordance with improvement in texture continuity of texture information respectively assigned to said each three-dimensional shape

constituent element and a three-dimensional shape constituent element adjacent thereto; and

means for assigning texture information to said three-dimensional shape constituent element by carrying out a weighted mean process according to an area of said three-dimensional shape constituent element projected on said each object image information on the basis of the object image information corresponding to said related label number and the object image information corresponding to a predetermined number of label numbers including said related label number.

41. A texture information assignment apparatus for a shape model, comprising:

means for describing a shape of an object of interest as a shape model by a set of a plurality of three-dimensional shape constituent elements;

means for relating, when a plurality of object image information are captured in accordance with regular change in position and a label number is assigned to each said object image information, correspondence between each said three-dimensional shape constituent element and said label number so as to minimize an evaluation function that decreases in accordance with increase of a texture information amount corresponding to said each three-dimensional shape constituent element, and that decreases in accordance with improvement in texture continuity of texture information respectively assigned to said each three-dimensional shape constituent element and a three-dimensional shape constituent element adjacent thereto; and

means for assigning texture information to said three-dimensional shape constituent element by carrying out a weighted mean process according to an area of said three-dimensional shape constituent element projected on said each object image information on the basis of object image information corresponding to said related label number and object image information corresponding to a predetermined number of label numbers including said related label number.

42. The texture information assignment apparatus for a shape model comprising:

means for capturing a plurality of object image information by shooting an object of interest from different viewpoints;

means for describing a shape of said object of interest as a shape model by a set of a plurality of three-dimensional shape constituent elements; and

means for assigning, to each said three-dimensional shape constituent element, texture information obtained by carrying out a weighted mean process for a plurality of said object image information according to an area of said three-dimensional shape constituent element projected on said plurality of object image information respectively.

43. An object extraction apparatus for extracting an object portion by removing an undesired portion from an object image obtained by shooting an object of interest, comprising:

region segmentation means for dividing said object image into a plurality of regions; and

extraction means for identifying and extracting the object portion in said object image by a process of consolidating information of each pixel in said object image each for said region.

44. The object extraction apparatus according to claim 43, wherein said process of consolidating information of each pixel in said object image each for said region in said extraction means is the process of averaging information of each pixel in said object image each for said region.

45. The object extraction apparatus according to claim 43 or 44, wherein said extraction means identifies and extracts the object portion in said object image by a threshold process for information of each said pixel consolidated each for said region.

46. The object extraction apparatus according to one of claims 43-45,

wherein said information of each pixel in said object image is difference information obtained by a difference process between a background image obtained by shooting only a background of said object of interest and said object image.

47. The object extraction apparatus according to one of claims 43-45, wherein said extraction means comprises

difference processing means for carrying out a difference process between a background image obtained by shooting only a background of said object of interest and said object image;

mean value obtaining means for obtaining a mean value of absolute values of difference obtained by said difference process in said each region, and

threshold value processing means for comparing said mean value of absolute values of difference in said region with a predetermined value to extract a region having said mean value of at least said predetermined value as the object portion.

48. The object extraction apparatus according to any of claims 43-45, wherein said extraction means comprises

mean value calculating means for calculating a mean value of pixels in each region of said object image,

difference processing means for carrying out a difference process between a mean value of pixels in each region of said object image and a mean value of pixels in a region of said background image corresponding to said region of said object image, and

threshold value processing means for comparing an absolute value of difference obtained by said difference processing means with a predetermined value to extract a region having said absolute value of difference of at least said predetermined value as the object portion.

49. The object extraction apparatus according to any of claims 43-45, wherein said information of each pixel in said object image is depth

information.

50. An object extraction method for extracting an object portion by removing an undesired portion from an object image obtained by shooting an object of interest, comprising:

a region segmentation step of dividing said object image into a plurality of regions; and

an extraction step of identifying and extracting the object portion in said object image by a process of consolidating information of each pixel in said object image each for said region.

51. The object extraction method according to claim 50, wherein said step of consolidating information of each pixel in said object image each for said region in said extraction step is the process of averaging information of each pixel in said object image each for said region.

52. The object extraction method according to claim 50 or 51, wherein said extraction step identifies and extracts the object portion in said object image by a threshold process for information of each said pixel consolidated each for said region.

53. The object extraction method according to one of claims 50-52, wherein said information of said each pixel in said object image is difference information obtained by a difference process between a background image obtained by shooting only a background of said object of interest and said object image.

54. The object extraction method according to any of claims 50-52, wherein said extraction step comprises

a difference processing step of carrying out a difference process between a background image obtained by shooting only a background of said object of interest and said object image,

a mean value obtaining step of obtaining a mean value of absolute

values of difference obtained by said difference process in said each region, and

a threshold value processing step of comparing said mean value of absolute values of difference in said region with a predetermined value to extract a region having said mean value of at least said predetermined value as the object portion.

55. The object extraction method according to any of claims 50-52, wherein said extraction step comprises

a mean value calculating step of calculating a mean value of pixels in each region of said object image,

a difference processing step of carrying out a difference process between a mean value of pixels in each region of said object image and a mean value of pixels in a region of said background image corresponding to said region of said object image, and

a threshold value processing step of comparing an absolute value of difference obtained by said difference processing with a predetermined value to extract a region having said absolute value of difference of at least said predetermined value as the object portion.

56. The object extraction method according to any of claims 50-52, wherein said information of each pixel in said object image is depth information.

57. A medium storing a program for causing a computer to extract an object portion by removing an undesired portion from an object image obtained by shooting an object of interest, said program comprising:

a region segmentation step of dividing said object image into a plurality of regions; and

an extraction step of identifying and extracting the object portion in said object image by a process of consolidating information of each pixel in said object image each for said region.

58. The medium storing the object extraction program according to claim 57, wherein said process of consolidating information of each pixel in said object image each for said region in said extraction step is the process of averaging information of each pixel in said object image each for said region.

59. The medium storing the object extraction program according to claim 57 or 58, wherein said extraction step identifies and extracts the object portion in said object image by a threshold value process for information of said each pixel consolidated each for said region.

60. The medium storing the object extraction program according to one of claims 57-59, wherein said information of each pixel in said object image is difference information obtained by a difference process between a background image obtained by shooting only a background of said object of interest and said object image.

61. The medium storing the object extraction program according to one of claims 57-59,

wherein said extraction step comprises

a difference processing step of carrying out difference processing between a background image obtained by shooting only a background of said object image and said object image,

a mean value obtaining step of obtaining a mean value of absolute values of difference obtained by said difference process in said each region, and

a threshold value processing step of comparing said mean value of an absolute values of difference in said region with a predetermined value to extract a region having said mean value of at least said predetermined value as the object portion.

62. The medium storing the object extraction program according to one of claims 57-59, wherein said extraction step comprises

a mean value calculating step of calculating a mean value of pixels in each region of said object image,

a difference processing step of carrying out a difference process between a mean value of pixels in each region of said object image and a mean value of pixels in a region of said background image corresponding to said region of said object image, and

a threshold value processing step of comparing an absolute value of difference obtained by said difference processing step with a predetermined value to extract a region having said difference absolute value of difference of at least said predetermined value as the object portion.

63. The medium storing the object extraction program according to one of claims 57-59, wherein said information of each pixel in said object image is depth information.

64. An object extraction apparatus for extracting an object portion by removing an undesired portion from an object image obtained by shooting an object of interest, comprising:

depth information calculating means for calculating depth information of said object image;

region segmentation means for dividing said object image into a plurality of regions;

mean value calculating means for calculating a mean value of said depth information each for said region; and

extraction means for extracting as said object portion a region having said mean value within a predetermined range out of said plurality of regions.

65. An object extraction method of extracting an object portion by removing an undesired portion from an object image obtained by shooting an object of interest, comprising the steps of:

calculating depth information of said object information,

dividing said object image into a plurality of regions,

calculating a mean value of said depth information each for said region, and

extracting as said object portion a region having said mean value within a predetermined range out of said plurality of regions.

66. A medium storing a program for causing a computer to extract an object portion by removing an undesired portion from an object image obtained by shooting an object of interest, said program comprising the steps of:

calculating depth information of said object information;

dividing said object image into a plurality of regions;

calculating a mean value of said depth information each for said region; and

extracting as said object portion a region having said mean value within a predetermined range out of said plurality of regions.

67. An object extraction apparatus for extracting an object portion by removing a background portion from an object image obtained by shooting an object of interest on the basis of said object image and a plurality of background images obtained by shooting only a background of said object of interest a plurality of times, comprising:

difference means for calculating an absolute value of difference between said object image and said background image;

extraction means for extracting as said object portion a portion of said object image having said absolute value of difference greater than a threshold value; and

threshold value determination means for determining said threshold value in a statistical manner according to image information distribution of said plurality of background images.

68. An object extraction apparatus for extracting an object portion by removing an undesired portion from an object image obtained by shooting an object of interest, on the basis of said object image and a

plurality of background images obtained by shooting only a background of said object of interest a plurality of times, comprising:

calculating means for calculating a mean value and standard deviation of pixels located at same coordinates in said plurality of background images each for said pixel;

difference means for calculating an absolute value of difference between a value of each pixel in said object image and a mean value of pixels in said background image corresponding to said pixel; and

extraction means for extracting as said object portion a pixel having said absolute value of difference greater than a predetermined times said standard deviation out of the pixels in said object image.

69. An object extraction apparatus for extracting an object portion by removing an undesired portion from an object image obtained by shooting an object of interest, on the basis of said object image and a plurality of background images obtained by shooting only a background of said object of interest a plurality of times, comprising:

average/standard deviation calculating means for calculating a mean value and standard deviation of pixels located at the same coordinates in said plurality of background images each for said pixel,

region segmentation means for dividing said object image into a plurality of regions;

difference means for calculating an absolute value of difference between a value of each pixel in each region of said object image and a mean value of corresponding pixels in a region of said background image corresponding to said region;

mean difference calculating means for calculating a mean value of said absolute values of difference each for said region;

mean standard deviation calculating means for calculating a mean value of said standard deviation each for said region; and

extraction means for extracting as said object portion a region having a mean value of said absolute values of difference greater than a predetermined times the mean value of said standard deviation out of said

plurality of regions.

70. An object extraction apparatus for extracting an object portion by removing an undesired portion from an object image obtained by shooting an object of interest, on the basis of said object image and a plurality of background images obtained by shooting only a background of said object of interest a plurality of times, comprising:

average/standard deviation calculating means for calculating a mean value and standard deviation of pixels located at same coordinates in said plurality of background images each for said pixel;

region segmentation means for dividing said object image into a plurality of regions;

mean calculating means for calculating a mean value of pixels in each region of said object image;

difference means for calculating an absolute value of difference between a mean value of pixels in each region of said object image and a mean value of pixels in a region of said background image corresponding to said region;

mean difference calculating means for calculating a mean value of said absolute value of difference each for said region;

mean standard deviation calculating means for calculating a mean value of said standard deviation each for said region; and

extraction means for extracting as said object portion a region having a mean value of said absolute value of difference greater than a predetermined times the mean value of said standard deviation out of said plurality of regions.

71. An object extraction apparatus for extracting an object image by removing an undesired portion from an object image on the basis of a plurality of object images obtained by shooting an object of interest a plurality of times and a plurality of background images obtained by shooting only a background of said object of interest a plurality of times, comprising:

means/standard deviation calculating means for calculating a mean value and standard deviation of pixels located at same coordinates in said plurality of background images each for said pixel;

mean calculating means for calculating a mean value of pixels located at same coordinates in said plurality of object images each for said pixel;

region segmentation means for dividing said object image into a plurality of regions;

difference means for calculating an absolute value of difference between said mean value of each pixel in each region of said object image and said mean value of corresponding pixel in a region of said background image corresponding to said region;

mean difference calculating means for calculating a mean value of said absolute value of difference each for said region;

mean standard deviation calculating means for calculating a mean value of said standard deviation each for said region; and

extraction means for extracting as said object portion a region having a mean value of said absolute value of difference greater than a predetermined times the mean value of said standard deviation out of said plurality of regions.

72. An object extraction method of extracting an object portion by removing an undesired portion from an object image obtained by shooting an object of interest, on the basis of said object image and a plurality of background images obtained by shooting only a background of said object of interest a plurality of times, comprising the steps of:

determining statistically a threshold value according to distribution of said plurality of background images;

calculating an absolute value of difference between said object image and said background image; and

extracting as said object portion a portion of said object image having said absolute value of difference greater than said threshold value.

73. An object extraction method of extracting an object portion by removing an undesired portion from an object image obtained by shooting an object of the interest, on the basis of said object image and a plurality of background images obtained by shooting only a background of said object of interest a plurality of times, comprising the steps of:

calculating a mean value and standard deviation of pixels located at the same coordinates in said plurality of background images each for said pixel;

calculating an absolute value of difference between a value of each pixel in said object image and a mean value of pixels in said background image corresponding to said pixel; and

extracting as said object portion a pixel having said absolute value of difference greater than a predetermined times said standard deviation out of the pixels in said object image.

74. An object extraction method of extracting an object portion by removing a background portion from an object image obtained by shooting an object of interest, on the basis of said object image and a plurality of background images obtained by shooting only a background of said object of interest a plurality of times, comprising the steps of:

calculating a mean value and standard deviation of pixels located at the same coordinates in said plurality of background images each for said pixel;

dividing said object image into a plurality of regions;

calculating an absolute value of difference between a value of each pixel in each region of said object image and a mean value of corresponding pixels in a region of said background image corresponding to said region;

calculating a mean value of said absolute value of difference each for said region;

calculating a mean value of said standard deviation each for said region; and

extracting as said object portion a region having a mean value of said absolute values of difference greater than a predetermined times the mean

value of said standard deviation out of said plurality of regions.

75. An object extraction method of extracting an object portion by removing an undesired portion from an object image obtained by shooting an object of the interest, on the basis of said object image and a plurality of background images obtained by shooting only a background of said object of interest a plurality of times, comprising the steps of:

calculating a mean value and standard deviation of pixels located at the same coordinates in said plurality of background images each for said pixel;

dividing said object image into a plurality of regions;

calculating a mean value of pixels in each region of said object image;

calculating an absolute value of difference between a mean value of pixels in each region in said object image and a mean value of pixels in a region of said background image corresponding to said region;

calculating a mean value of said absolute value of difference each for said region;

calculating a mean value of said standard deviation each for said region; and

extracting as said object portion a region having a mean value of said absolute value of difference greater than a predetermined times the mean value of said standard deviation out of said plurality of regions.

76. An object extraction method of extracting an object portion by removing an undesired portion from an object image on the basis of a plurality of object images obtained by shooting an object of interest a plurality of times and a plurality of background images obtained by shooting only a background of said object of interest a plurality of times, comprising the steps of:

calculating a mean value and standard deviation of pixels located at the same coordinates in said plurality of background images each for said pixel;

calculating a mean value of pixels located at the same coordinates in

said plurality of object images each for said pixel;

dividing said object image into a plurality of regions;

calculating an absolute value of difference between said mean value of each pixel in each region of said object image and said mean value of corresponding pixel in a region of said background image corresponding to said region;

calculating a mean value of said absolute value of difference each for said region;

calculating a mean value of said standard deviation each for said region; and

extracting as said object portion a region having a mean value of said absolute value of difference greater than a predetermined times the mean value of said standard deviation out of said plurality of regions.

77. A medium storing a program for causing a computer to extract an object portion by removing an undesired portion from an object image obtained by shooting an object of interest on the basis of said object image and a plurality of background images obtained by shooting a background of said object of interest a plurality of times, said program comprising the steps of:

determining statistically a threshold value according to distribution of said plurality of background images;

calculating an absolute value of difference between said object image and said background image;

extracting as said object portion a portion of said object image having said absolute value of difference greater than said predetermined value.

78. A medium storing a program for causing a computer to extract an object portion by removing an undesired portion from an object image obtained by shooting an object of interest, on the basis of said object image and a plurality of background images obtained by shooting only a background of said object of interest a plurality of times, said program comprising the steps of:

calculating a mean value and standard deviation of pixels located at the same coordinates in said plurality of background images each for said pixel;

calculating an absolute value of difference between a value of each pixel in said object image and a mean value of pixels in said background image corresponding to said pixel; and

extracting as said object portion a pixel having said absolute value of difference greater than a predetermined times said standard deviation out of the pixels in said object image.

79. A medium storing a program for causing a computer to extract an object portion by removing an undesired portion from an object image obtained by shooting an object of interest, on the basis of said object image and a plurality of background images obtained by shooting only a background of said object of interest a plurality of times, said program comprising the steps of:

calculating a mean value and standard deviation of pixels located at the same coordinates in said plurality of background images each for said pixel;

dividing said object image into a plurality of regions;

calculating an absolute value of difference between a value of each pixel in each region of said object image and a mean value of corresponding pixels in a region of said background image corresponding to said region;

calculating a mean value of said absolute value of difference each for said region;

calculating a mean value of said standard deviation each for said region; and

extracting as said object portion a region having a mean value of said absolute values of difference greater than a predetermined times the mean value of said standard deviation out of said plurality of regions.

80. A medium storing a program for causing a computer to extract an object portion by removing an undesired portion from an object image

obtained by shooting an object of interest, on the basis of said object image and a plurality of background images obtained by shooting only a background of said object of interest a plurality of times, said program comprising the steps of:

calculating a mean value and standard deviation of pixels located at the same coordinates in said plurality of background images each for said pixel;

dividing said object image into a plurality of regions;

calculating a mean value of pixels in each region of said object image;

calculating an absolute value of difference between a mean value of pixels in each region in said object image and a mean value of pixels in a region of said background image corresponding to said region;

calculating a mean value of said absolute value of difference each for said region;

calculating a mean value of said standard deviation each for said region; and

extracting as said object portion a region having a mean value of said absolute value of difference greater than a predetermined times the mean value of said standard deviation out of said plurality of regions.

81. A medium storing a program for causing a computer to extract an object portion by removing an undesired portion from an object image on the basis of a plurality of object images obtained by shooting an object of interest a plurality of times and a plurality of background images obtained by shooting only a background of said object of interest a plurality of times, said program comprising the steps of:

calculating a mean value and standard deviation located at the same coordinates in said plurality of background images each for said pixel;

calculating a mean value of pixels located at the same coordinates in said plurality of object images each for said pixel;

dividing said object image into a plurality of regions;

calculating an absolute value of difference between said mean value of each pixel in each region of said object image and said mean value of

corresponding pixel in a region of said background image corresponding to said region;

calculating a mean value of said absolute value of difference each for said region;

calculating a mean value of said standard deviation each for said region; and

extracting as said object portion a region having a mean value of said absolute value of difference greater than a predetermined times the mean value of said standard deviation out of said plurality of regions.

82. A three-dimensional mode production apparatus for producing a three-dimensional model of an object of interest, comprising:

shooting means for shooting a background of said object of interest and for shooting said object of interest including said background;

silhouette production means for producing a plurality of silhouette images by obtaining difference between a background image obtained by shooting only said background and a plurality of object images obtained by shooting said object of interest including said background; and

means for producing a three-dimensional model of said object of interest using said plurality of silhouette images.

83. The three-dimensional model production apparatus according to claim 82, further comprising rotary means for rotating said object of interest.

84. A three-dimensional model production apparatus for producing a three-dimensional model of an object of interest, comprising:

silhouette production means for producing a plurality of silhouette images of said object of interest;

estimation means for estimating an existing region of said object of interest in voxel space according to said plurality of silhouette images; and

means for producing a three-dimensional model of said object of interest using said existing region of said object of interest obtained by said

estimation means.

85. The three-dimensional model production apparatus according to claim 84, wherein said estimation means carries out a voting process on said voxel space.

86. The three-dimensional model production apparatus according to claim 85, further comprising threshold value processing means for setting a portion having a voting score of at least a predetermined threshold value as said existing region of said object of interest as a result of said voting process.

87. A three-dimensional model production method of producing a three-dimensional model of an object of interest, comprising the steps of:

shooting only a background of said object of interest by a pickup device to obtain a background image;

shooting said object of interest including said background by said pickup device to obtain a plurality of object images;

producing a plurality of silhouette images by obtaining difference between said background image and said plurality of object images; and

producing a three-dimensional model of said object of interest using said plurality of silhouette images.

88. The three-dimensional model production method according to claim 87, further comprising the step of rotating said object of interest.

89. A three-dimensional model production method of producing a three-dimensional model of an object of interest, comprising the steps of:

producing a plurality of silhouette images of said object of interest;

estimating an existing region of said object of interest in voxel space according to said plurality of silhouette images; and

producing said three-dimensional model using said estimated existing region of said object of interest.

90. The three-dimensional model production method according to claim 89, wherein said step of estimating carries out a voting process on said voxel space.

91. The three-dimensional model production method according to claim 90, further comprising the step of setting a portion having a voting score of at least a predetermined threshold value as said existing region of said object of interest as a result of said voting process.

92. A medium storing a program for causing a computer to produce a three-dimensional model of an object of interest, said program comprising the steps of:

producing a plurality of silhouette images from said object of interest;

estimating an existing region of said object of interest in voxel space according to said plurality of silhouette images and;

producing said three-dimensional model using said estimated existing region of said object of interest.

93. The medium storing the three-dimensional model production program according to claim 92, wherein said step of estimating in said program carries out a voting process on said voxel space.

94. The medium storing the three-dimensional model production program according to claim 93, wherein said program further comprises the step of setting a portion having a voting score of at least a predetermined threshold value as said existing region of said object of interest as a result of said voting process.

95. An object extraction apparatus for extracting an object portion by removing an undesired portion from an object image obtained by shooting an object of interest, on the basis of said object image and a

plurality of background images obtained by shooting only a background of said object of interest a plurality of times, comprising:

mean/standard deviation calculating means for calculating a mean value and standard deviation of pixels located at the same coordinates in said plurality of background images each for said pixel ;

region segmentation means for dividing said object image into a plurality of regions;

mean calculating means for calculating a mean value of pixels in each region of said object image and a mean value in each region of the mean value of pixels in the background image;

difference means for calculating an absolute value of difference between a mean value of pixels within each region of said object image and a mean value in the region of pixels in a region of said background image corresponding to said region;

mean standard deviation calculating means for calculating a mean value of said standard deviation each for said region; and

extraction means for extracting as the object region a region having an absolute value of difference greater than a predetermined times the mean value of said standard deviation out of said plurality of regions.

96. An object extraction method of extracting an object portion by removing an undesired portion from an object image obtained by shooting an object of interest, on the basis of said object image and a plurality of background images obtained by shooting only a background of said object of interest a plurality of times, comprising the steps of:

calculating a mean value and standard deviation of pixels located at the same coordinates in said plurality of background images each for said pixel;

dividing said object image into a plurality of regions;

calculating a mean value of pixels in each region of said object image and a mean value in each region of the mean value of the pixels in the background image;

calculating an absolute value of difference between a mean value of

pixels within each region of said object image and a mean value in the region of pixels in a region of said background image corresponding to said region;

calculating a mean value of said standard deviation each for said region; and

extracting as the object portion a region having an absolute value of difference greater than a predetermined times the mean value of said standard deviation out of said plurality of regions.

97. A medium storing a program for causing a computer to extract an object portion by removing an undesired portion from an object image obtained by shooting an object of interest, on the basis of said object image and a plurality of background images obtained by shooting only a background of said object of interest a plurality of times, comprising the steps of:

calculating a mean value and standard deviation of pixels located at the same coordinate in said plurality of background images each for said pixel;

dividing said object image into a plurality of regions;

calculating a mean value of pixels in each region of said object image and a mean value in each region of the mean values of the pixels of the background image;

calculating an absolute value of difference between a mean value of pixels within each region of said object image and a mean value in the region of pixels in a region of said background image corresponding to said region;

calculating a mean value of said standard deviation each for said region; and

extracting as the object portion a region having an absolute value of difference greater than a predetermined times the mean value of said standard deviation out of said plurality of regions.